by arclightshroom

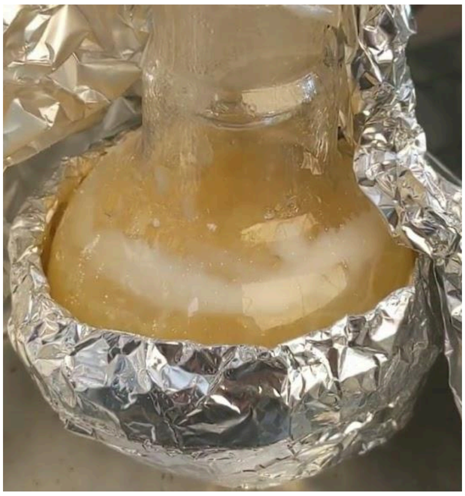
DMT SYNTHESIS AND INVESTIGATION ON IT’S POLYMORPHISM

DMT is a psychedelic on the class of tryptamines, and it’s one of the most famous one due to its high potency and ability to induce spiritual experiences. It is usually extracted from plant matter, but this work hopes to prove how viable the synthesis is and to share some knowledge on the matter.

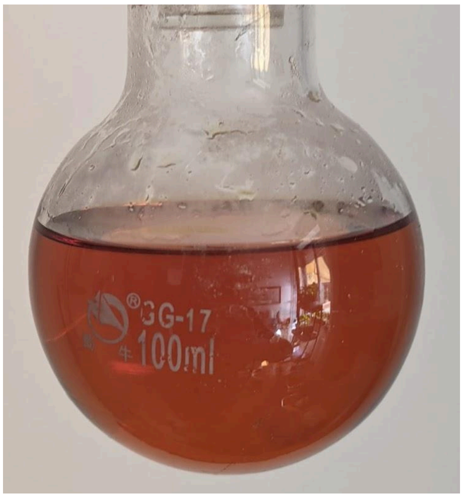
WARNING: Despite this project being easy and accessible to new bees, chemistry is dangerous, and proper PPE must be taken before attempting.

Synthesis of tryptamine

20g of tryptophan are suspended in 60mL benzyl alcohol with 1mL of spearmint oil (containing approx. 98% carvone) and the flask purged with nitrogen and heated in an oil bath. At around 150°C spontaneous gas evolution started, peaking at 180°C, the temperature was kept there for 90 minutes. After cooling to room temperature the mixture was extracted with 3x20mL 1M HCl, the aqueous extracts washed abundantly with DCM and basified with a concentrated NaOH solution. 11.2g of tryptamine is collected by filtration as a white fluffy solid in 71% yield.

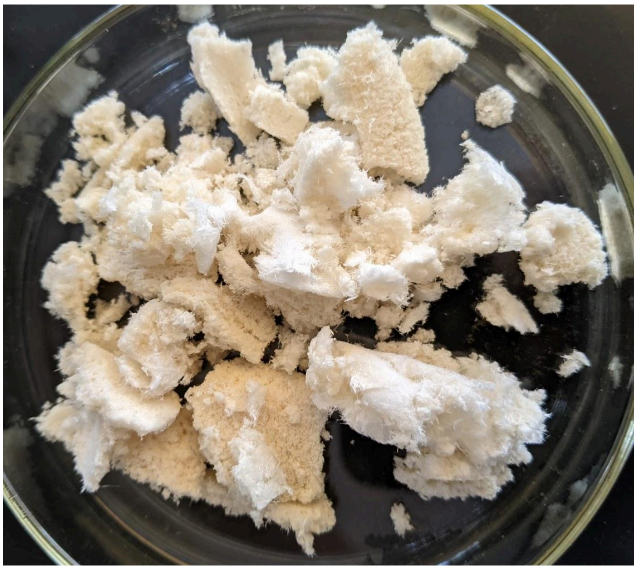


Tryptophan doesn’t dissolve well in benzyl alcohol, it forms a thick slurry

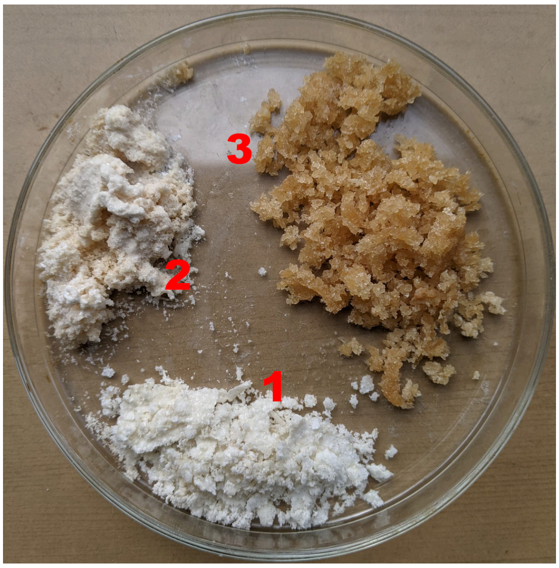


After reacting the slurry becomes a clear red liquid

NOTE: Nitrogen is not necessary, it just helps with the yield, but considering how cheap the starting materials are, even a 30% yield would be great. Yields are a bit inconsistent in my experience, ranging from 40 to 80% with no apparent reason, at least that I could think of. Also, tryptamine darkens pretty fast in open air, brown tryptamine is still completely fine (commercial tryptamine is brownish), but the cleaner the better later on, so it’s better to use it immediately.



Clean fresh tryptamine



Tryptamine after 1 minute (1), 1 hour (2), 1 day (3)

Synthesis of DMT by reductive alkylation

10g of tryptamine are dissolved in 350mL of methanol in a 500mL flask, which is stoppered with a rubber septum and cooled in the freezer. Then 10.21g of 36% formaldehyde (2 molar equivalents) is added and the flask returned to the freezer for 10 minutes, with occasional hand swirling in between. Sodium borohydride, 2.83g (0.6 molar equivalents of formaldehyde) is added in portions to the flask having care to keep the temperature below 0°C. All the hydride is usually added in 3-4 portions 15 minutes apart from each other; the flask stays in the freezer the whole time with occasional swirling. The septum is punctured with a needle before the addition, to let hydrogen escape. After all the hydride is added the flask is then left reacting for 1 hour cold, then 40 minutes submerged in a 50°C water bath. This procedure corresponds to 1 cycle, and it's repeated 3 more times (freeze, formaldehyde 10 minutes, $NaBH_4$, 1 hours, hot bath 40 minutes) using 6.13g of formaldehyde (1.2 eq.) and 1.7g $NaBH_4$ (0.6 eq of formaldehyde). After the 4th and last cycle half of the methanol is removed under vacuum, then 100mL of 5% aqueous sodium carbonate solution are added and the majority of the methanol is removed, leaving about 150mL of volume. 50mL of diethyl ether are added and the mixture stirred for 5 minutes, the layers are separated and the water washed with 2x20mL ether. The combined organic phases are washed with brine, dried over sodium sulfate and desolventized, to yield a red goop.

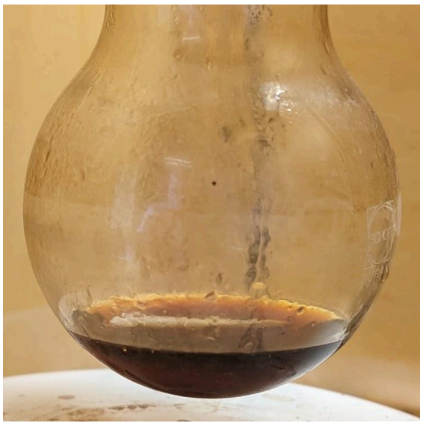
By the end of the 4 cycles color lightens visibly

NOTE: The goop is purified in a particular way, doing an extra A/B extraction or distilling it under vacuum is possible, but not worth the hassle in my opinion, considering the crystallization procedure is equally tedious in any case, and yields a product of identical purity.

The reaction is very easy and can be done entirely in a borosilicate container inside the freezer without particular equipment, but it's important to be very careful about reaction conditions such as times and temperature, on which the entire experiment depends. To recap:

- Reaction mixture is cooled before beginning a cycle, the temperature should be -15°C or lower.
- 2eq (if cycle 1) or 1.2eq (if cycle 2-4) of formaldehyde are added, and left reacting for 10 minutes.
- Sodium borohydride 0.6eq (in respect of formaldehyde) is added in portions, temperature must stay under 0°C. After all has been added the flask is left in the freezer for at least 1 hour.
- Reaction mixture is quenched for 40 minutes at 50°C at the end of each cycle.

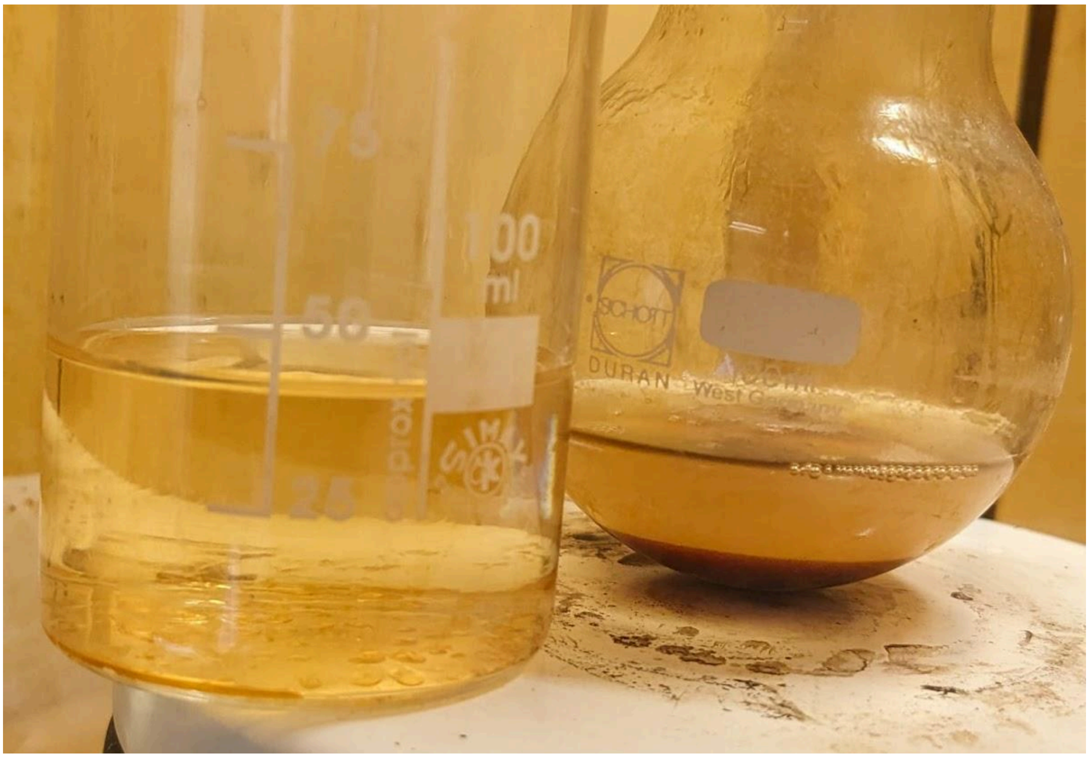
Repeat 4 times.



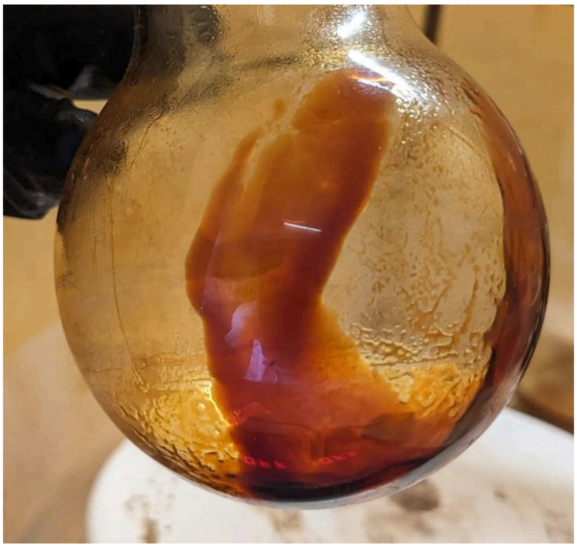
Tarry goop after ether removal.

Purification, crystallization and separation of 2 polymorphs

To the flask containing the goop 20mL of n-hexane are added, and the biphasic mixture stirred and heated to reflux. After heating up the hexane becomes cloudy, and after 1-2 minutes of reflux it turns clear again. After this happens the solvent is decanted to a pre heated beaker, and fresh hexane is added. This is repeated until the goop disappears, and only a small amount of insoluble tar is left behind, for this run it took 4 20mL hexane portions. While the mixture is under reflux the previous decanted extracts must be kept hot, near boiling. The solution should be light yellow and completely transparent. After only tar is left, the hexane extract is reduced to 50mL and cooled to room temperature. On cooling the mixture becomes opaque and oil starts to crash out and pooling at the bottom. The solvent is decanted from the oil in another hot beaker and reheated to boiling, the bottom and walls are scratched with a glass rod, then everything is wrapped in aluminum foil and put in the freezer. The oil is put in the freezer too. From the hexane DMT deposits as big white crystals where the glass was scratched, while the oil is retrieved as a honey like substance. This honey solidifies to a waxy solid after being aggressively stirred with a spatula. In total 8.53g of DMT are collected with a 72% yield. Of this 72%, 23% corresponds to polymorph A (amorphous wax) and 49% to polymorph B (crystalline). Polymorph A has a melting range of 44-46°C, polymorph B 56-58°C.

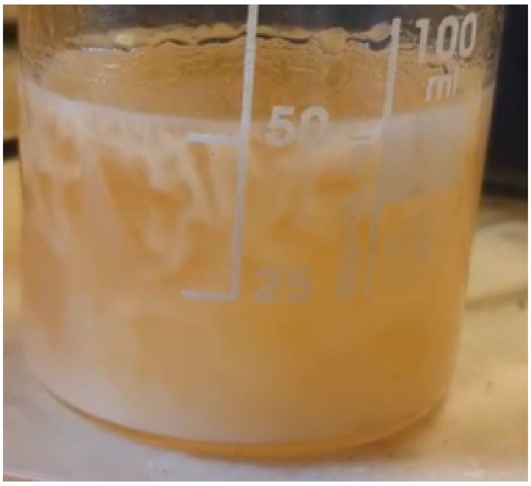


In the boiling flask is observed hot hexane (cloudy top layer) and the goop (dense bottom layer), and in the beaker the extracts. Before decanting the cloudy hexane must become like the one in the beaker, yellow and transparent.

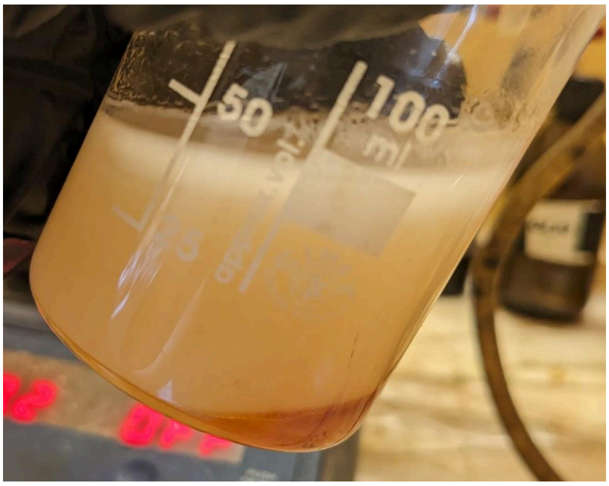


Insoluble crap left behind

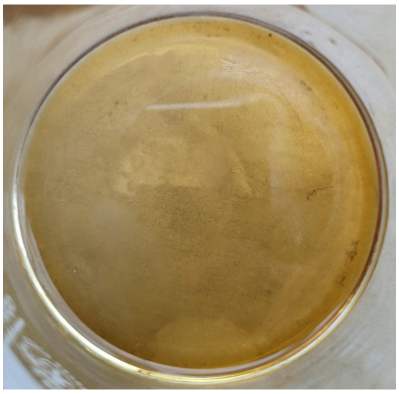
Clean extracts



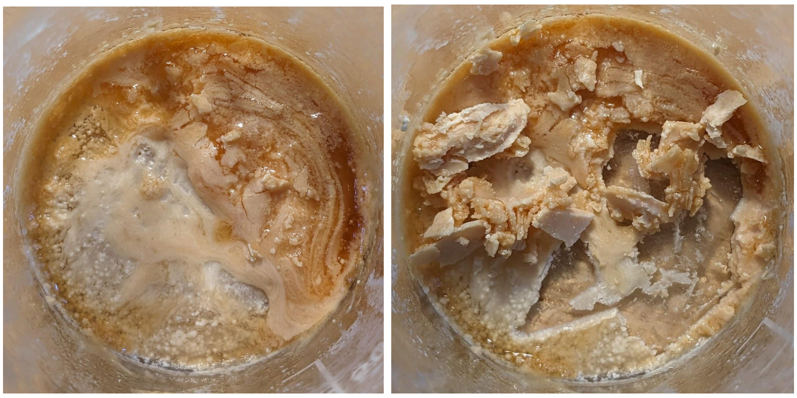
Oil crashing on cooling



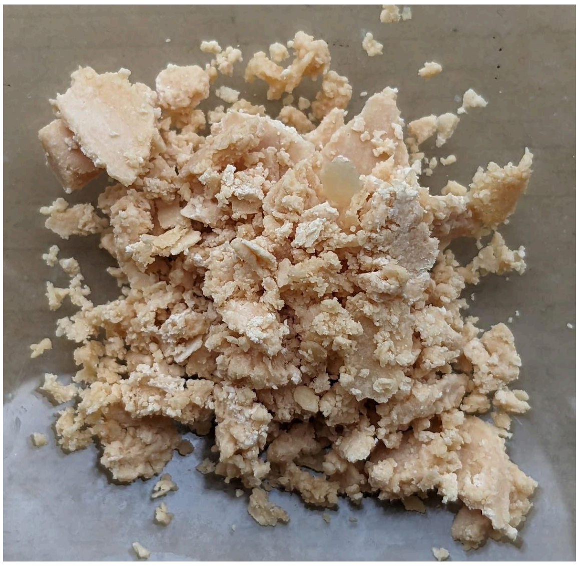
After a good portion of oil has collected at the bottom the rest of the hexane is transferred and re heated



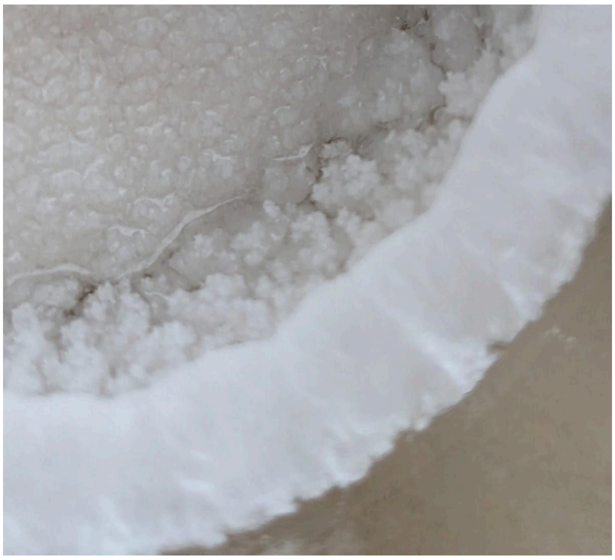
Oil out the freezer



Moving it round with the spatula makes it solidify



Polymorph A, amorphous



Polymorph B, crystalline

TLC ANALYSIS: Eluent EtOAc:EtOH:NH_3 (conc.) 40:30:3. Visualized with $KMnO_4$ stain

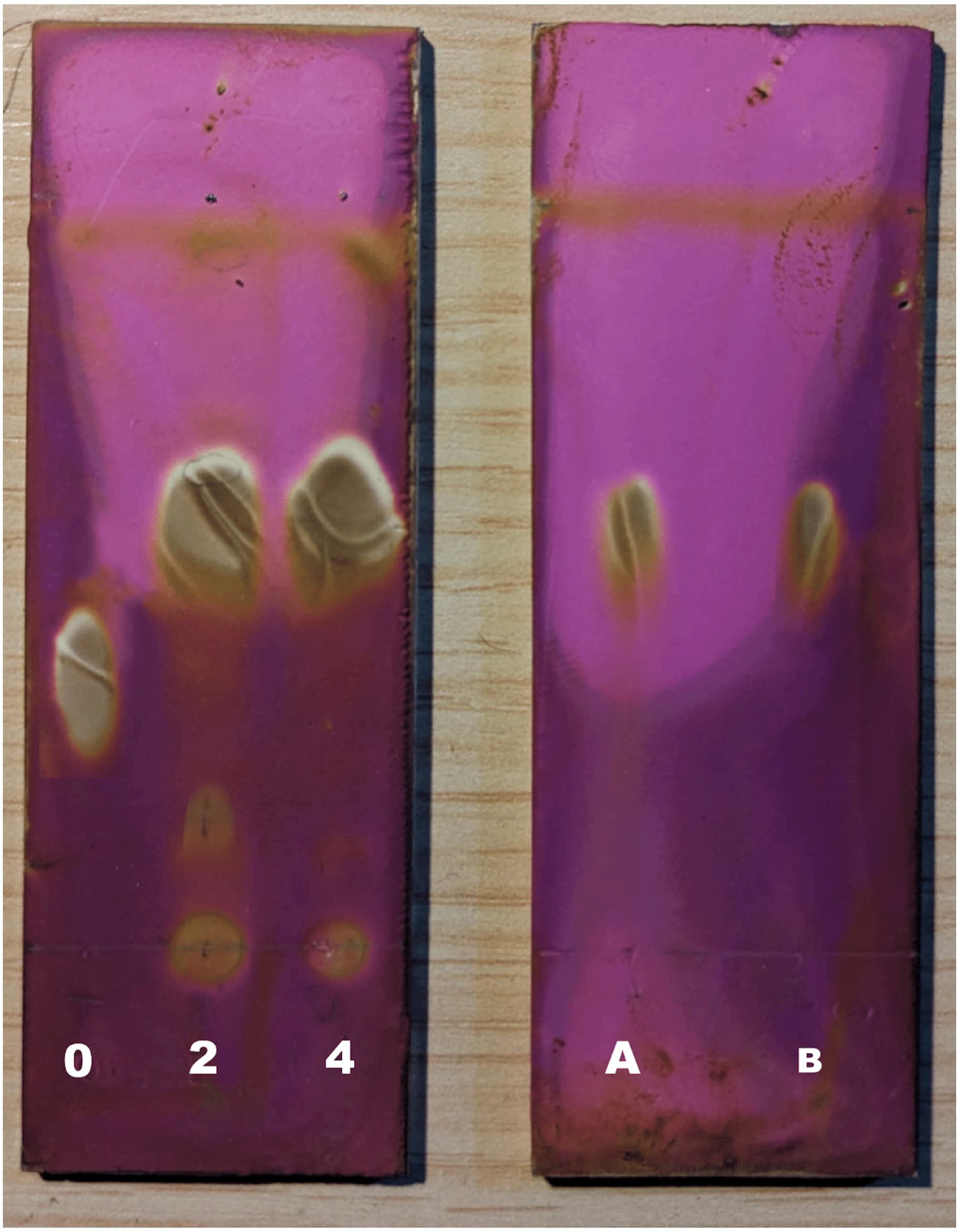


Plate 1:

- Row 0: Tryptamine, Rf: 0.43
- Row 2: Reaction mixture after 2nd cycle. Most of the tryptamine is already converted to DMT, but there is tar at the origin, a lower spot (NMT?) with Rf: 0.15 and an upper spot with Rf: 0.96
- Row 4: Reaction cycle after 4th cycle. Omnipresent tar, lower spot has disappeared, top spot persists.

Plate 2: Polymorph A and B of DMT, identical, Rf: 0.58